HEMINGWAY Name:

Evolution Review

*** Please ensure to complete you visual dictionary***

****As this was a LARGE unit, ensure you check over the unit outline to make sure you cover all sections that will be on the test****

Learning outcome

B1: Describe the influences that Lamarck, Lyell, Malthus, & Darwin brought to the development of the theory of evolution.

1. How do Darwin's and Lamarck's ideas of evolution compare?

Lamarck was one of the first people to recognize that organisms change over time. Lamarck thought that organisms have an innate desire to change and that acquired characteristics could be passed down. Although flawed, Lamarck helped influence Darwins Thinking. Darwin theorized that species change due to a process called natural selection which is based on the points of overproduction, competition, variation and natural selection. Those individuals who are most fit are able to survive, reproduce and pass on their genes.

2. How did Lyell and Malthus contribute to Darwin's theory of evolution?

Lyell and Hutton brought up the idea that the earth is much older than previously thought and that it changes slowly over time. This got Darwin thinking that if the earth changes slowly over time, why not organisms?

Malthus studied in the area of population economics, looking at how the human population size was kept in check by war, famine, disease ect. This got Darwin thinking about how more organisms in the natural world are produced than can survive, which led him to ask the question why?

3. How did Wallace contribute to Darwin?

Wallace went on his own expedition to the Malay Archipelago after Darwin's journey. He came up with a lot of the same finding as Darwin and wrote to him. This prompted Darwin to finally publish his On the Origin of Species.

4. What were Darwin's 4 key ideas in his theory of Evolution?
    a. Note key information about each idea
        i. Overproduction
            1. More offspring are produced than can survive
        ii. Variation
            1. There is variation within the population
        iii. Competition
            1. There is competition for resources (food habitat etc)
        iv. Natural Selection
            1. Those individuals who are most fit will be able to survive, reproduce and pass on there genes.

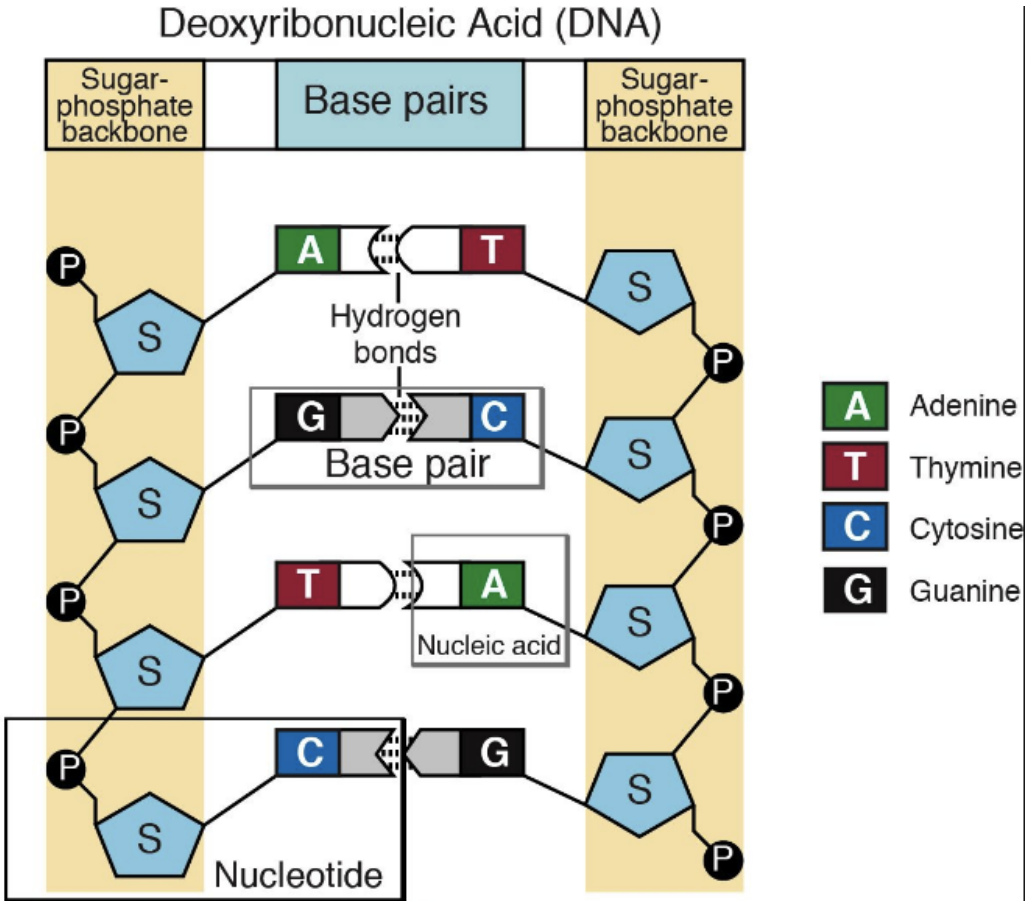
5. What does descent with modification mean?

All organisms have descended with changes from a common ancestor.

6. What provides evidence for evolution? Discuss each one
    a. Fossil record
    b. Homologous structures
    c. Distribution of Species
    d. Vestigial Structures
    e. Embryology

B2. I can describe the basic structure of DNA

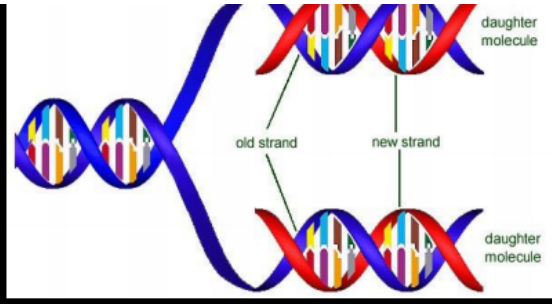
1. What is the structure and function of DNA
    a. Include sugar, phosphate, nitrogenous bases, complementary base paring and indicate a nucleotide.
2. DNA is the blueprint for the survival and development of the organism. DNA is the biological basis for Evolution.

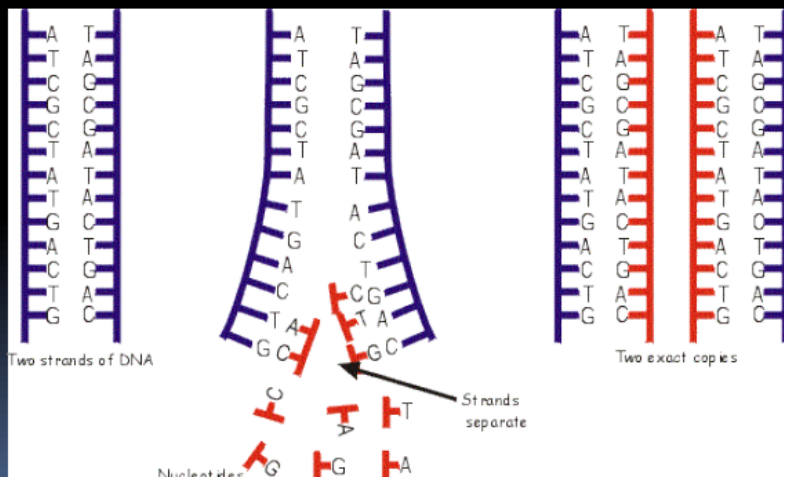


3. How and why does DNA replicate? Include all enzymes involved (a diagram may help)

DNA Replication

- DNA molecule opens up
  - Enzyme: DNA Helicase
- New nucleotides join opened sides
  - Enzyme: DNA Polymerase
- Backbone of sugar – phosphate is sealed
  - Enzyme : DNA Ligase
- New DNA
  - One parent strand
  - One daughter strand





B3. I can explain the role of DNA in Evolution

1. What is a gene? A genome?

A gene is a segment of DNA that codes for a specific protein or trait. A genome is the total of an organisms genes.

2. What is an allele?

Version of a gene (ie allele for blue eyes vs brown eyes)

3. What is the difference between phenotype and genotype? Give an example

BB-genotype Blue eyes-phenotype

Genotype is the part of the DNA sequence and the phenotype is the expression of that sequence

4. Compare haploid and diploid cells

Haploid have have the genetic information (23 chromosomes for humans)

Ex: Gametes (sperm & egg)

Diploid have a full set of chromosomes (46)

Ex: skin cells

5. What are two sources of genetic variation?

Meiosis/Sexual Reproduction and Mutation

6. What is a gene pool?

The collection of all of the genes present in a population

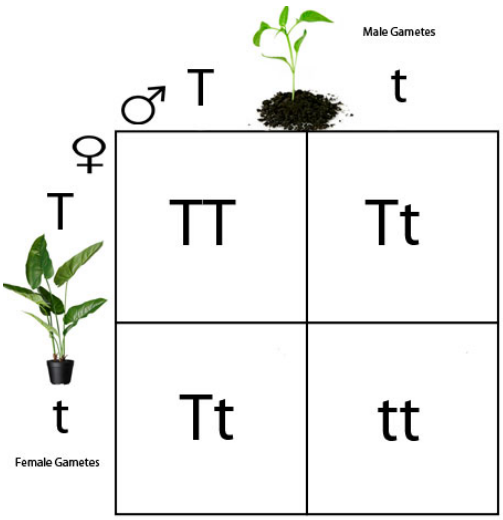
7. What is relative frequency? How can we use this to define evolution?

Relative frequency of alleles is how often we see certain traits within the population. If the frequency of alleles in a population changes, then we can say that that population is evolving.

8. Who was Gregor Mendel?

He is known as the father of genetics. He has done extensive research with pea plants that show how heritable information is passed on.

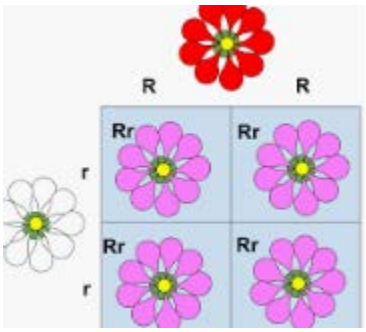
9. Using a Punnett square, explain how probability and genetics are related. Include terms like heterozygous and homozygous.



Each time an organism reproduces there is a probability of certain offspring. Each reproduction is an independent event and the same probability will occur. In the above example. The female parent and male parent are both heterozygous. Presume that the dominant trait is tall (T) and the recessive trait is short (t). They have a 3:1 phenotypic ratio of tall:short and 1:2:1 genotypic ratio of TT:Tt:tt. TT represents homozygous dominant, Tt represents heterozygous and tt represents homozygous recessive.

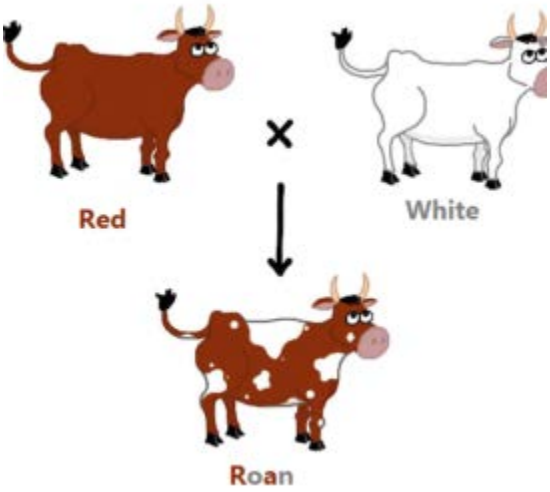
10. What is incomplete dominance?

When neither allele is dominant which results in a blending of phenotype



11. What is codominance

When both alleles contribute to phenotype



12. What is the difference between dominant and recessive genes?

Dominant genes will be expressed if the individual carries the dominant allele (TT or Tt)

Recessive genes will only be expressed if the individual carries both copies (tt)

13. Are an organisms genes the only influence in how an organism will develop?

No, the environment also plays a part in the development of an organism

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Ie what they eat, where the live etc

14. Why is the study of genetics so important to how organisms evolve?

Allows us to predict how certain organisms will change and how genes are passed on.

B4: I can describe the five agents of evolutionary change

1. What is Natural Selection?

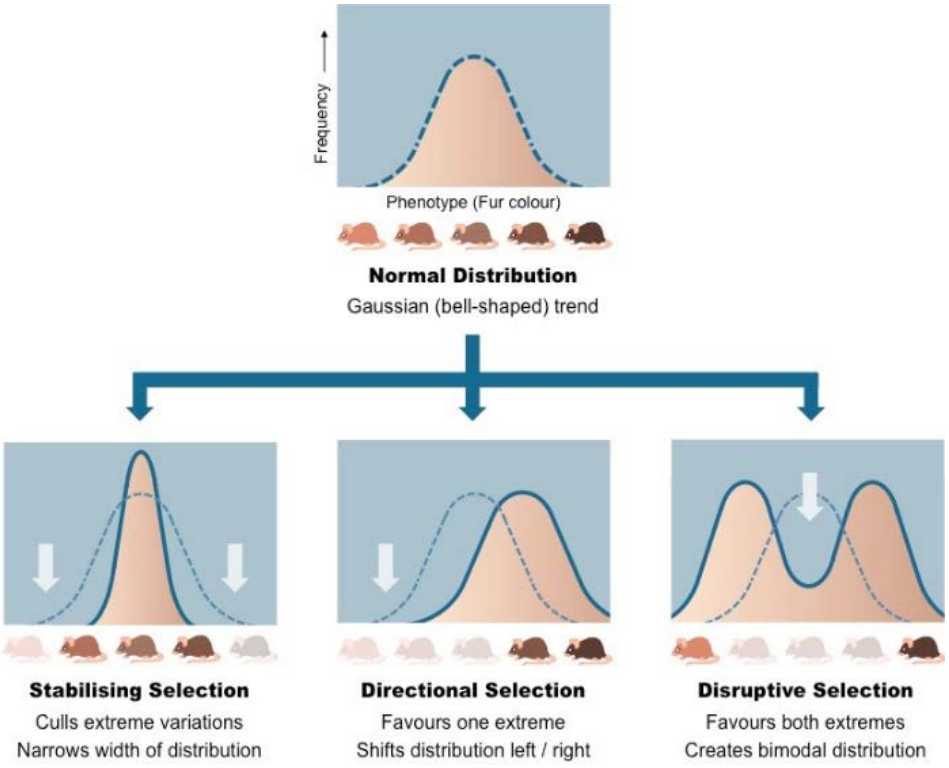
The individuals with the best traits / adaptations will survive and have the opportunity to pass on its traits to offspring.

2. What does it mean to be a "fit" individual in a population?
   An organism's fitness is related to how well it is able to survive and reproduce in its environment. Favourable adaptations enable fitness.

3. Does natural selection act upon the individual? Explain

   Natural selection acts upon the population as a whole, specifically the phenotype or traits visable. The individual may change (via mutation) which can lead to the population as a whole changing.

4. What is the difference between Directional, Disruptive and Stabilizing selection? What results from each?



5. What is Sexual Selection?

When some mates are more desirable than others. This disturbs random breeding and results in Directional Selection. It May result in extreme characteristics

6. Choose either the "Peppered Moth" or "Weirderoos" activity and explain how they demonstrated Natural Selection in action.

Within the population of peppered moths there was variation. When the environment changed (pollution) the darker variation had an advantage which in turn increased its fitness. As more moths are produced than can survive the adaptation gave them an advantage so They were able to survive and reproduce more than the lighter variety which led to a change in the frequency of alleles. The population now had more individuals with darker wings to avoid predation.

7. Why does Non-random mating lead to evolutionary change?

When organisms choose their mate based on certain characteristics, not every member of the population has an equal opportunity to reproduce. This can cause a shift in the frequency of alleles to the "preferred" allele. For example, if a female bird chose her mate based on the colour of the males tail, then only the "prettiest" males would be able to survive and reproduce which would lead to more "pretty" tails.

8. How can mutation lead to evolutionary change? Where does the mutation have to occur?

Mutations add in a new allele to the gene pool which changes the frequency of alleles. If this mutation is beneficial then you will slowly see more of the allele appear in the population. The mutation must occur in the gametes in order to be passed on.

9. How does genetic drift occur? Why only in small populations? How does this lead to evolution?

Genetic drift occurs when a small group of an original population are separated. It must be a small group so that chance can take over. The small sample group has a higher chance not to represent the population as a whole and if they are isolated will form a new gene pool. This new gene pool will most likely be different from the original population.

10. How does gene flow lead to evolution?

Gene flow represents the flow in and out of a population. As individuals move in and out they change the frequency of alleles which causes the population to change (evolve)

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B5. Speciation: how new species evolve

1. What is speciation?

The development of a new species

2. What is a niche? What happens when two species occupy the same niche?

A niche is an organism role in its environment. Where it lives, what it eats, how it behaves etc. If two species are trying to occupy the same niche then competition will occur and only one will be successful.

3. How does speciation occur? Name three types of isolation.

Speciation occurs when a group of individuals from an original population become isolated in some way. 1. Geographic isolation – a physical separation, 2. Behavioural isolation-a behaviour (dance, song etc) that separates then from the original population 3. Temporal isolation-reproduce at different times. All three isolations if kept up for long enough allow natural selection to act upon the individuals. Eventually they become so different genetically that they will not be able to reproduce fertile offspring with the original population. Speciation occurs once they have become reproductively isolated.

4. Explain how Darwin's finches are an example of speciation.

The 14 finch species have all developed from a common ancestral mainland species (adaptive radiation) Originally part of the original population was blown over to the Galapagos through a storm. The were then geographically isolated. Once on the new island They were able to colonize the island and populate quickly. Competition for resources occurred and variants of the population that were able to occupy different niches were able to survive and reproduce. The beak type of the finches was the selecting factor that affected the development of all of the different species. Over time the finches became genetically different and were reproductively isolated from one another. New niches open opportunity for new species to develop.

5. What are the three main steps of speciation?

   1. Separation of populations (Founder populations)

   2. Changes in the Gene pool due to natural selection

   3. Reproductive Isolation

6. What is Adaptive Radiation?

When many species develop from one common anscestor (divergent evolution)

7. What is Divergent Evolution? Proof?

A number of different species diverge from a common ancestor

During adaptive radiation, organisms evolve a variety of characteristics

This allows them to survive in different niches

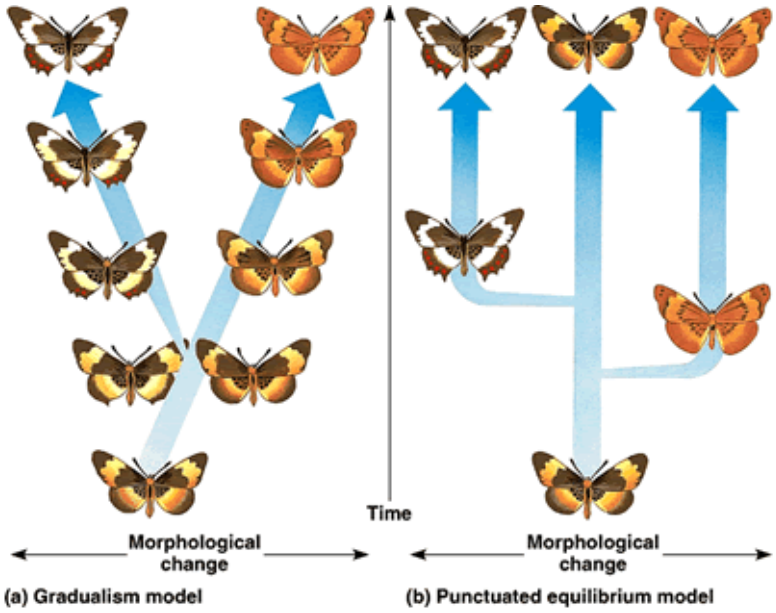
Evidence: Homologous body structures (show common ancestor)

8. What is Convergent Evolution? Proof?

   convergent evolution: It is the phenomena in which adaptive radiation among different organisms produce species that are similar in appearance and behaviour. This Produces analogous structures which have same function different structure.(Insect wing and bird wing)

B6. I can compare the gradual change model with the punctuated equilibrium model of evolution.

1. Compare and contrast the Gradual and Punctuated Equilibrium models. (Diagram may help)



Gradualism is the theory that organisms change slowly over time.

Punctuated Equilibrium describes the pattern of long stable periods (equilibrium), interrupted by brief periods of rapid change

2. Why do species go extinct?

Competition for resources, habitat etc, Changing environment, Natural selection, Mass extinctions that wipe out entire ecosystems

3. How can mass extinctions cause bursts of evolution?

When these events occur many niches are left empty. The species that remain that are able to survive and reproduce can potentially evolve to fill those empty niches. This forms many new species in the process. There is a Burst of evolution (Adaptive Radiation) The extinction of the dinosaurs cleared the way for the evolution of modern mammals and birds.